
Flood Plain Management

Section 206: Technical Assistance
Rhode Island

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**US Army Corps
of Engineers**
New England Division

A Handbook For Flood Plain
Management in Rhode Island

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Introduction

The flood plain in its natural state acts as a safety valve, storing the overflow from swollen streams during severe storm events or heavy snowmelt. As other developable land becomes less abundant, and flood plain land is developed, the flood plain's natural function can result in substantial financial losses. The present state of flood plain use and development is a holdover from a time in which the impacts of uncontrolled growth were not understood. The public, however, has become increasingly concerned about the impacts of flood plain development with respect to increased exposure to flood losses and the resultant public costs. A flood plain management program is a means of choosing the best and/or least disruptive use of the flood plain.

Purpose and Authority

The State of Rhode Island requested assistance from the New England Division, Corps of Engineers in preparing a handbook on flood plain management.

Authority for Corps of Engineers participation in this effort is contained in Section 206 of the 1960 Flood Control Act which states:

"...The Secretary of the Army, through the Chief of Engineers, Department of the Army, is hereby authorized to compile and disseminate information on floods and flood damages...general criteria for guidance in the use of flood plain areas and to provide engineering advice to local interests for their use in planning to ameliorate the flood hazard..."

The purpose of this report is to outline the various structural and non-structural measures available to help alleviate flood losses. These measures may be implemented at every level of government-Federal, State, and local-as well as by the individual.

Part I - An Overview of Flood Plain Management

A. Goals and Objectives

The overall objective of a flood plain management program is to reduce losses due to floods. There are two basic means by which to accomplish this. The first is to insure that any future development that occurs in a flood prone area is compatible to that area. The second is to reduce the damages from existing development. When translated into concrete plans, guidelines and ordinances, the objectives provide a basis for regulating land uses and planning public investments.

The critical element in translating the conceptual image of flood plain management into a workable program is implementation. There should be enough flexibility in the program to permit the land owner reasonable choices in the use of his property, while simultaneously protecting the public's legitimate interests in flood plain values.

There are a number of techniques that can be used, alone or in combination, to ensure a program's effectiveness. The appropriate technique in each case depends upon the location of a particular land parcel with respect to the flood plain, the future development pattern indicated on the community's comprehensive plan, and the surrounding land use pattern. To maintain a program's beneficial impact, there must be a continuous process of planning, implementation and operation.

B. Basic Concepts

The flood plain in its natural state may be looked upon as a safety valve. When storms or heavy snowmelt provide too much water for a stream channel to handle, the excess water overflows the stream banks and pours onto the flood plain (Figure 1). This presented no problems until man began encroaching upon flood plains. Virtually all major cities were founded in coastal or riverine areas because of the ready access to waterborne transportation to move people and goods. Flood plains, enriched with nutrients deposited by periodic floods became desirable farm lands. As industries grew, they, too, were lured to flood plains which allowed them access to the river for various uses: to transport raw materials and finished products; for cooling water and hydropower; and as a convenient outlet for their wastes.

Time and again floods destroyed properties that had been built on the flood plains (Figure 2). Yet, despite the inherent risks, the potential benefits continue to entice man to gamble upon building in the flood plain. Whatever the motivation, the results of our intrusions upon flood plains are all too often personal suffering and loss (Figure 3) and the public burden of rescue and relief operations at the expense of all taxpayers.

Flood plain management is a means of choosing the best and/or least disruptive use of the flood plain. The list of flood plain uses and management purposes is extensive and includes provisions for recreation, fish and wildlife habitat, navigation, agriculture, and municipal and industrial water supply. Some communities are finding it difficult to maintain a balance between the increasing pressures to develop flood plain land as other undeveloped land becomes less abundant, and the increasing recognition that the natural and beneficial values served by the flood plain represent valuable environmental resources. The goal of each community therefore, is to attain the optimal balance of: (1) economic efficiency; (2) environmental quality; and (3) individual safety, peace of mind and social well-being.

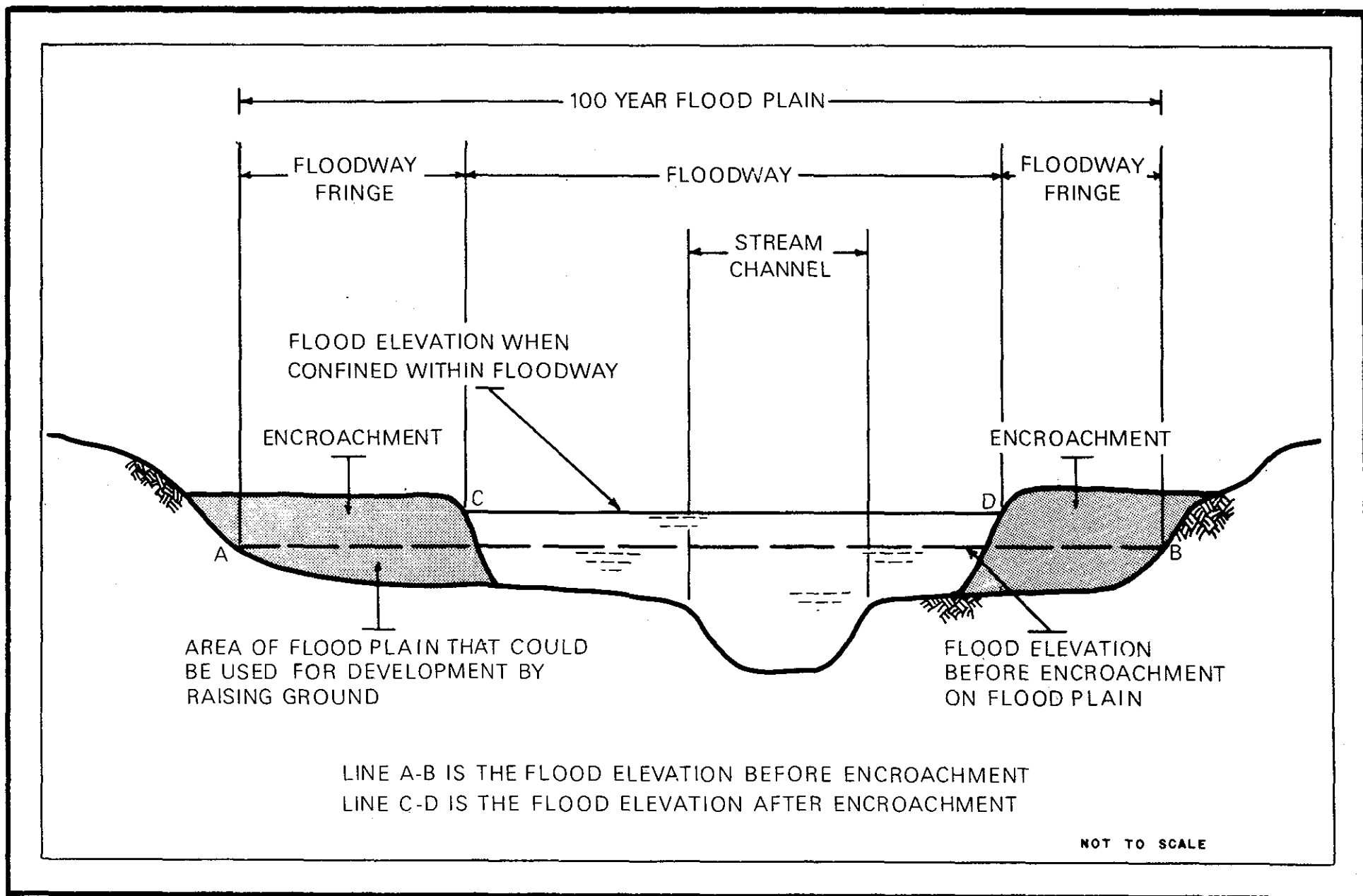


FIGURE 1

Effects of Encroachment Upon the Flood Plain



FIGURE 2

Woonsocket, RI.

August 1955



FIGURE 3

Manville, RI.

August 1955

Part II - Flood Plain Natural Values, Strategies and Tools for Management

Flood plains evolved from natural forces over a gradual period of tens of thousands of years. Yet, after only a comparatively brief span of time of settlement in this country, the natural values of many flood plains have been altered by human actions. Consequently, the flood plain's natural values and vulnerability and the means by which to preserve and restore each have become a major concern.

A. Natural and Beneficial Flood Plain Values

Surface waters, their flood plains, and their watersheds should be viewed as one ecological system existing in a state of dynamic equilibrium. If one part of the system is disturbed the entire system will readjust into a new state of equilibrium, the effects of which are often felt for a great distance over a long period of time.

Flood plains in their natural or relatively undisturbed state provide three broad sets of natural and beneficial resource values: (1) water resources; (2) living resources; and (3) cultural resources.

Most of the natural water, plant, animal and cultural resources of flood plains do not benefit just one specific site. The natural value benefits extend throughout the river system or coast, affecting many citizens and communities.

1. Water Resources Values

a. Natural Flood Storage and Conveyance

The relationship of the flood plain with respect to flooding is a cyclical one. Floods shape flood plain topography and soils and influence ecology. In turn, the physical characteristics of the flood plain shape flood flows, by providing a broad area to spread out and temporarily store floodwaters, thereby reducing flood peaks and velocities and the potential for erosion.

b. Water Quality Maintenance

Flood plains are important in maintaining the physical, biological and chemical integrity of the water body. Surface runoff that enters a main water body from a barren flood plain may deposit large amounts of sediment and debris into the stream. Water traveling across a vegetated flood plain is slowed, causing it to drop most of its sediment load on the flood plain. This filtering process may add rich nutrients to the ground surface.

2. Living Resources and Habitat Values

Coastal and riverine flood plains support a wide variety of plants and animals which constitute aesthetic and economic resources.

Flood plains provide an excellent site for agricultural, aquacultural, and forest production. The natural processes of sediment transport and deposition tend to replenish flood plain soils with nutrients. Agricultural operations flourish due to the gently rolling terrain, and the availability of surface and groundwater supplies. Aquacultural operations have grown into a viable industry producing a wide variety of aquatic crops. Bottomland hardwoods and associated species, which flourish in close proximity to water, are important to the timber industry and the overall economy of the country.

Flood plains serve as breeding, nursery and feeding grounds for estuarine and marine fisheries as well as support waterfowl, furbearers and other wildlife species.

3. Cultural Resources Values

Flood plains contain many important cultural resources. As previously mentioned, the earliest settlements and cities were established along the coasts and rivers. Consequently, many of the nation's earliest archaeological and historical sites are located in flood plains. Flood plains may also contain invaluable resources for scientific research. For example, many flood plains contain unique ecological habitats. In urban areas, flood plains may provide green belt areas to break urban development monotony, absorb noise, clean the air, and lower temperatures.

Because of their scenic value and other, often unique, beneficial characteristics, flood plains are attractive recreation sites. Water-oriented sports, such as boating and swimming are often available in flood plain parks as well as hiking and camping facilities. Wildlife resources can be maintained for observation as well as for recreational hunting and fishing.

B. Vulnerability of Natural Flood Plain Values

Man's encroachment upon the flood plain can be compared in part to nature's extremes, such as earthquakes and floods. Both tend to cause major disruptions of natural processes. However, while there is generally a recovery period that follows a natural disruption, human intrusions remove the conditions under which natural processes can continue. It is important to keep in mind that nature's extremes are part of a continuing cycle. It is neither possible nor desirable to eliminate these extremes. Rather, it is the intent of a flood plain management program to minimize the effects of man's intrusions upon the flood plains. The following discussions should be viewed in this context.

1. Water Resources

Development and modification of natural flood plains generally result in three forms of adverse conditions: (1) increased runoff; (2) blocked runoff or groundwater movement; and (3) increased pollution loadings.

Actions that accelerate runoff (widespread clearing, wetlands destruction, dune removal, paving and roofing, etc.) reduce the amount of water entering the ground, and frequently cause increases in flood peaks, stream erosion and the sediment loading of receiving waters. The filtering action of vegetation on runoff is diminished. Runoff temperatures are raised when flowing over paved surfaces and roofs during warmer months which may result in lowering oxygen levels creating adverse impacts on aquatic life.

Deep foundations, buildings, road and other fills, dikes and dams may block runoff or interrupt groundwater flow. These structures may raise floodwater profiles, contribute to saturated conditions, and increase temperatures and pollution by impeding stream flow and retarding runoff. If structures extend deeply into flood plain soil they can cut off the movement of groundwater. If structures intercept the shore zone, they interfere with the distribution of sediment, which is so important to natural shore development. Increased pollution loadings further degrade the surface water ecosystem. Fertilizers, chemical and petroleum spills, and leached products of waste disposal areas can go directly into receiving waters either in solution or carried on sediments.

2. Living Resources

Development and modification of the flood plain have direct, adverse impacts on living resources. Increased sedimentation may bury food sources and spawning areas. Increased pollution loadings may poison and deprive living resources of oxygen. In addition, development typically removes cover, and hence shelter, for game and presents barriers to the movement of wildlife from their natural habitat to water bodies. Since flood plain wetlands are major sources of food and breeding habitat for fish and wildlife, the impacts may extend far beyond the development site.

3. Cultural Resources

The adverse impacts of flood plain development and modification on cultural resources have often been overlooked. Accelerated runoff, blocked runoff, interrupted groundwater flow, and increased pollution loadings frequently destroy or degrade educational sites (historical, archaeological, and scientific) and aesthetic qualities (urban open space and sound absorption). Poor agricultural, aquacultural, and forestry land use practices can be just as destructive to flood plain values as the more obvious structural forms of development.

Part III - Flood Damage Prevention

The focus of flood plain management is a wise choice among varied uses competing for a limited number of spaces. As discussed earlier in this report, it is the role of each community to determine the extent and type of development to be allowed in their individual flood plains. The ideal state for a flood plain is a natural, vegetated one. However, as desirable undeveloped land becomes less abundant, pressure to develop the flood plain increases. The present state of flood plain use and development is a holdover from an earlier period in which the full range of impacts of uncontrolled growth were not fully understood. However, the public has become increasingly concerned about flood plain development decisions, the rising exposure to flood losses, and the resultant public costs.

This section will deal with measures which can be taken to either modify existing flood losses or prevent future flood losses.

A. Structural Measures

Structural flood damage prevention measures modify flooding by altering the natural environment. Some examples of these measures include dams, levees and channel improvements. These flood control measures permit changes in the volume of runoff, in the peak stage of the flood, in the time of rise and duration, in the extent of the area flooded, in the velocity and depth of flood waters, and consequently in the amount of debris, sediment and pollutants that floods carry.

1. Dams and Reservoirs (Figure 4)

One of the most effective flood modifying measure is the storage of floodwaters in reservoirs. When streamflow is excessive, the reservoir impounds water and gradually releases it as the flood threat diminishes. Reservoirs and dams allow reductions in flood flow rate and in the extent of the area flooded. Dams and reservoirs also have potential for wide multiple purpose uses that more localized measures may not achieve.

2. Levees or Walls (Figures 5 and 6)

Levees and walls decrease the impact of flooding by acting as a barrier between vulnerable structures and the stream. They are constructed in the flood plain near the normal streamway to give maximum protection but encroach as little as possible on the natural floodway.

One advantage of a wall or levee is that its feasibility is not limited to a particular type or size of structure. However, the construction of walls and levees reduces the amount of flood plain area available for storage of excess floodwater and can, consequently increase the height of the flood upstream and downstream. Floodwalls and levees may cut off access and are not as adaptable to multiple purpose uses as are reservoirs.



FIGURE 4 Dam at South Main Street Bridge - Upper
Woonsocket Local Protection

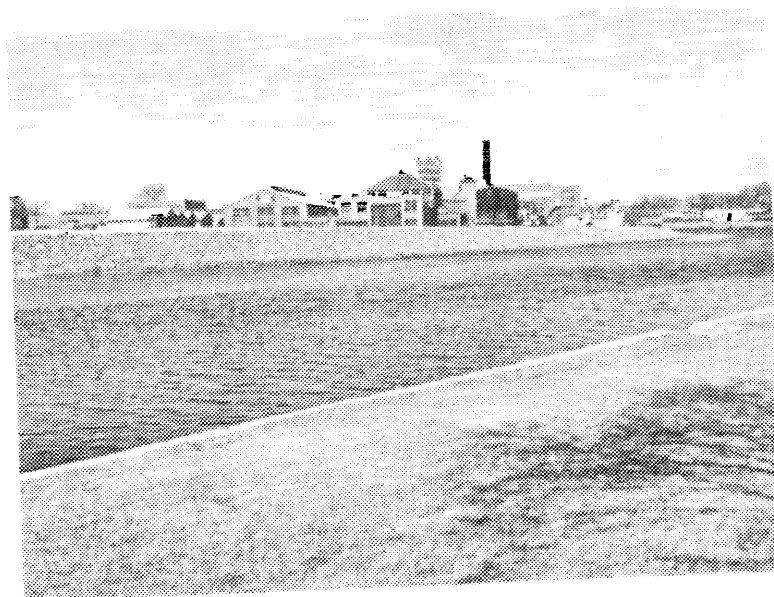


FIGURE 5 Stonington, CT. - Pawcatuck Local Protection



FIGURE 6 Pawcatuck Local Protection



FIGURE 7 Woonsocket Local Protection - Channel Improvements

3. Channel Improvements (Figure 7)

The purpose of channel improvement work is to increase the capacity and/or flow rate by any or all of the following:

Straightening bends to improve flow and reduce streambank erosion.
Deepening or widening the waterway to increase its carrying capacity.
Clearing brush, trees or other obstructions to floodflow.
Lining a channel with concrete or stone to provide smooth surfaces and improved flow.

Improving channel flow may, however, present complications. Enlarging a channel and shortening its course disturbs the stream regimen and, in turn, the existing ecology. To assure proper channel functioning, clearing operations may be necessary. Maintenance costs may be high unless the channel and stream banks are stable. Concrete or stone lining increases construction costs and may be aesthetically undesirable in some locations.

4. Watershed Treatment

Watershed treatment, generally applied to small land areas, is a means of decreasing peak flows by slowing the rate at which surface runoff enters a stream. This is accomplished by increasing infiltration through such methods as selective planting and forestation, contour plowing, and maintaining loose soils.

5. Onsite Detention Measures

Whereas watershed treatment is appropriate primarily for nonurban areas, onsite detention measures can provide temporary storage of urban runoff waters. For assured effectiveness these measures require continuous maintenance. Temporary storage may result in increased infiltration of flood waters.

6. High Flow Diversions and Spillways (Figure 8)

Flood damage reduction may also be achieved by the provision of high flow diversions or floodway bypasses which redirect excess flows away from a streamway with inadequate capacity. Natural or artificially constructed bypass channels serve two functions. First, they decrease flow in the channel downstream from the head of the bypass and reduce water levels there. Second, by providing an outlet for flood flows, they improve flow characteristics and decrease flood stage for a distance upstream from the head of the bypass.

Flood flow diversion application requires certain physical conditions. River valley topography must permit diversion waterways and provide low value land. In some circumstances such diversions may sharply alter downstream flow patterns and discharges, thereby producing unwanted environmental effects.

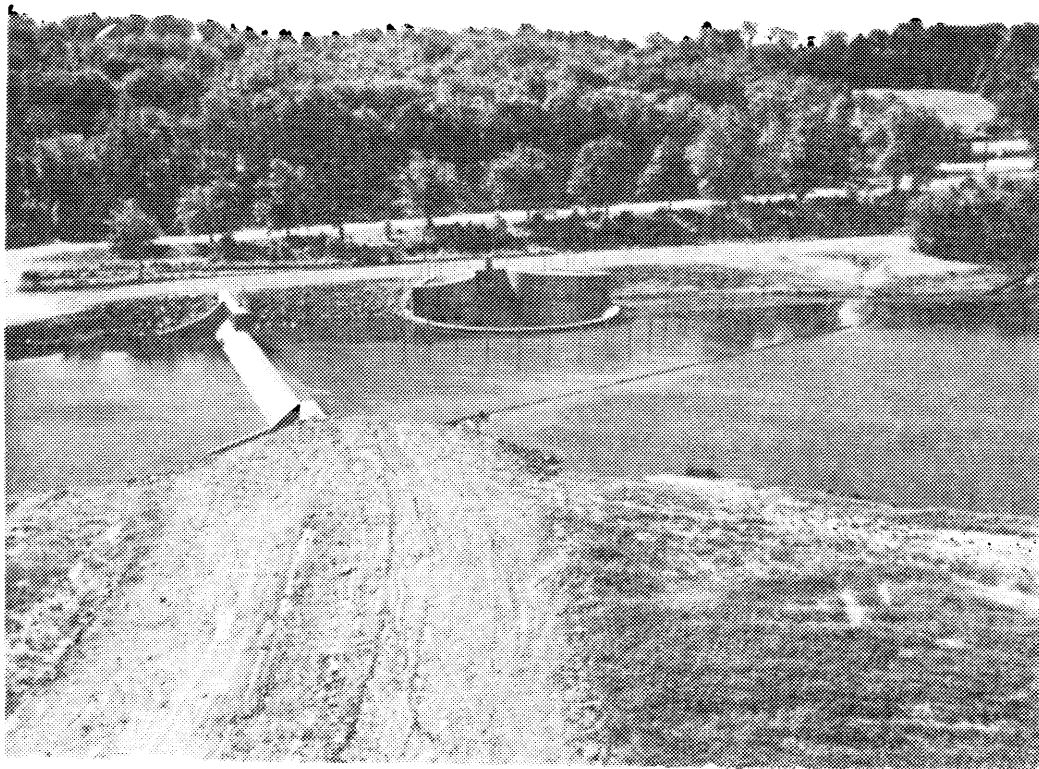


FIGURE 8 Worcester, MA. - Diversion intake portal and weir

B. Non-Structural Measures

Non-structural measures attempt to modify flood damage susceptibility by restricting the type and extent of development that will occur in the flood plain. These measures generally take the form of land use regulations or development/redevelopment policies but they may also include public information and education programs, tax adjustments, flood proofing, flood insurance and flood forecasting and warning systems. These measures can be used individually, but communities can benefit from a combination of measures to achieve relief from the damaging effects of future floods.

1. Flood Plain Regulations

a. Zoning Ordinances

Zoning may be used to set special standards for land uses in flood hazard areas, including specifications for minimum floor elevations. Floodway limits are delineated and any new structural uses and land alterations which would result in a flood stage increase are prohibited. The degree of regulations in effect in an area would depend largely on the extent of flood hazard present in the area.

All cities and towns in the State have adopted local zoning regulations and the majority also control the subdivision of land. At the minimum, the land use controls comply with the NFIP regulations. However, several coastal communities have exceeded the NFIP minimum regulations by adopting land use controls for high hazard areas that prohibit all but temporary occupation and usage.

b. Subdivision Regulations

Subdivision regulations specify conditions for the legal division of large parcels of land into smaller lots for purchase or development. Relative to flood plain management, subdivision regulations may require the installation of proper drainage facilities, notation of flood hazard areas on neighborhood subdivision maps, avoidance of encroachment into flood plain areas, and determination of the most appropriate method of structure elevation above the regulatory flood height.

c. Building Codes

Another preventive tool designed for flood damage reduction is legislation which controls building design and use of construction materials. Building codes do not restrict land use or development yet can reduce flood damage by setting specifications which:

- a) require anchorage to prevent flotation of buildings from their foundations
- b) establish basement elevations and minimum first floor elevations consistent with potential floods
- c) require a structure design which can withstand pressure or high velocity of flood waters
- d) restrict the use of materials which deteriorate when exposed to water
- e) require that electrical outlets and mechanical equipment be stored above the regulatory flood height or that the property be floodproofed.

The State Building Code was adopted in 1977 and generally incorporates all the applicable NFIP construction requirements. Administration and enforcement of the code is mainly a local government function.

d. Housing Codes

Housing codes set minimum standards for construction, but also require minimum standards for maintenance in an attempt to prevent blight and ensure occupant safety. Housing codes may be used to require a minimum standard for repair of flood-damaged structures.

e. Sanitary and Well Codes

These regulations are designed to decrease flood damage by establishing minimum standards for waste disposal and water supply. Often, onsite waste disposal facilities, such as septic tanks, are prohibited in flood hazard areas. In many cases, public sewer systems must be floodproofed.

Well codes outline special floodproofing requirements for facilities located in flood hazard areas to guard against contamination from flood waters. Rhode Island State Building Codes require that all new or replacement water supply systems be designed to minimize or eliminate infiltration of flood waters in the system. New and replacement sanitary sewage systems must be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters. Also, on-site waste disposal systems must be located to avoid impairment to them or contamination from them during flooding.

2. Development and Redevelopment Policies

Acting in an advisory capacity, public policies can guide development and modify susceptibility to flooding. Although not regulatory controls, development policies are designed to protect the flood hazard area.

a. Design and Location of Services and Utilities

As mentioned earlier, development in the flood plain should be carefully regulated. Local governments may abide by this through a design and location of utilities policy. Locating public facilities, such as libraries, schools, and post offices, away from flood hazard areas not only lessens their possibility of flood damage, but also deters private development. By guiding private and public development to areas not subject to flooding, local governments are reducing flood loss potential.

b. Land Rights, Acquisition, and Open Space Use

Implementation of this policy allows the purchase of land directly or the purchase of easements (i.e. the right of limited land use) for the purpose of controlling future development or preserving open space in the flood plain. Acquisition is often a costly alternative to flood plain management but in some cases is the only viable approach, particularly if the parcel is proposed for public use. Easements are occasionally used to continue agricultural use of land. Ownership, however, cannot be converted from private to public through regulation enforcement.

Preservation of open space has become increasingly more important in recent years. Parcels of open space adjacent to streams, lakes, and oceans have a natural attraction and are easily adapted to recreational areas. Lands not suitable for development can easily be converted to parks, playgrounds, and picnic areas. Increasingly, communities are preserving flood plains as open space in order to develop recreational centers and consequently minimize flood damage through non-development.

c. Permanent Evacuation

One of the least common tools for flood damage reduction, permanent evacuation calls for the purchase of lands, relocation of structures, facilities, and population. The acquired space can be adapted to recreational or agricultural use, which would not disrupt flood flows.

3. Public Information and Education

Of vital importance in effective flood plain management is an informative, comprehensive communications program. Planners and officials involved in flood plain management must be knowledgeable of flood hazard information, the focus of their interpretation and application. Topics of critical importance are:

- hydrology and hydraulics of small to very large floods in areas subject to inundation
- the role of the flood plain
- the impact of land use decisions on expected flooding
- the attributes of the flood plain.

This information will in turn help formulate flood plain management approaches. Main emphasis should be placed on material which will stimulate individual and local action: probability of loss; extent of financial loss; extent of inundation; and concise material which will enrich public awareness.

4. Tax Adjustments

Tax adjustments are another tool through which inappropriate use of flood plain land can be discouraged. When commercial/industrial or residential developments begin to encroach on primarily agricultural land, value increases. Consequently, taxes on agricultural land rise. Tax adjustments at the Federal, State or local level are designed to preserve what natural, agricultural land use exists. Tax concessions also help lessen the pressure of commercial development.

The tax structure must recognize and apply to its system regulatory aspects of land use. First, low density use achieved by regulations can be supported by low taxes for that use. Additionally, in a flood event, losses may be claimed in Federal and State income taxes-providing some financial relief. Special allowances may be issued on real estate taxes following a flood.

5. Flood Insurance

The National Flood Insurance Program (NFIP) was established in 1968 as part of a comprehensive effort to reduce flood damages and cope with the disastrous effects of floods. The Program establishes minimum flood plain management standards for designated flood prone communities.

Flood insurance allows the homeowner to minimize the amount of monetary damage they would be subject to if a flood occurred. Insurance also reduces the amount of Federal assistance that would be provided for flood disaster relief.

The NFIP consists of two essential components; insurance to cover the risks of existing development, and flood plain management to guide both new development and major changes to existing development.

A community that wishes to apply for admittance to the NFIP must submit an application to the Program Regional Office and adopt preliminary

flood plain management measures. Once this application has been approved, the community enters the Emergency Program. At this stage, limited amounts of insurance coverage are available throughout the community. A Flood Hazard Boundary Map (FHBM) is made available at this time which outlines the floodprone areas within the community.

During the period of Emergency Program eligibility, the Federal Insurance Administration conducts a detailed, technical study of the community's flood hazard area. The purpose of this Flood Insurance Study is to:

- investigate the existence and severity of flood hazards
- delineate the extent of floodprone areas
- determine the flood insurance rate zones
- determine minimum safe elevations for structures in special flood hazard areas
- recommend the floodway or channel required to discharge the 100-year flood, or the coastal high hazard area.

When the study has been completed, there is a review period which gives citizens and community officials the opportunity to evaluate the findings. After any appeals have been resolved, the Flood Insurance Rate Map (FIRM), the FHBM and the water surface elevations become the official flood data for the community. Once the FIRM becomes effective, the community may enter the Regular Program. At this time, the insurance available under the Emergency Program may be supplemented by insurance based on actuarial rates to provide the maximum coverage allowed under the Program.

Within six months of the date the FIRM becomes effective, the community must adopt more stringent flood plain management regulations for the identified flood hazard areas. If such regulations are not adopted, the community is suspended from the Program, and the sale and renewal of flood insurance ceases.

The community is responsible for enforcing its flood plain regulations. The FIA monitors the status and progress of each community by reviewing an annual report prepared and submitted by each community.

6. Flood Forecasting and Warning Systems

Preparedness for any disaster is essential for public safety and minimization of property losses. The Federal government has been responsible for forecasting the occurrence and magnitude of floods, due to the complicated interstate factors that must be considered. Specifically, the National Oceanic and Atmospheric Administration (the National Weather

Service) provides flood forecasts for the major river systems across the country, while others, like the Corps of Engineers and Tennessee Valley Authority provide services for specific areas.

Many communities, however, still lack proper flood forecasting and warning systems. The inability to effectively disseminate information, implement proper evacuation plans and help provide temporary housing for displaced persons is an unnecessary hindrance to flood hazard prevention. Communities should inquire into the availability of a flood forecasting service and, in conjunction with the National Oceanic and Atmospheric Administration, begin preparing plans for an effective warning system in their community. A well-executed flood warning system depends largely upon speedy public awareness, time available, action taken in response to flood warning, and effective use of police, fire, and rescue squads and radio and television stations. A previously developed emergency plan which spells out actions to be taken is mandatory.

7. Floodproofing (Figure 9)

Floodproofing consists of modifications to structures and building contents to keep water out or to reduce the effects of water entry. These adjustments can be installed during periods of construction, repair, remodeling or expansion.

Floodproofing, like other flood damage prevention methods, does have limitations. It can tend to generate a false sense of security and if used indiscriminately, can increase unwise flood plain use. If floodproofing measures are applied to a structurally inadequate building, it could result in more damages than if the building was not floodproofed.

Floodproofing can be a very important part of a broad program for comprehensive flood plain management. As developable land becomes more scarce, particularly in urban areas, flood plain development may become necessary.

There are basically three types of floodproofing measures; permanent, temporary or emergency. Floodproofing measures may be applied to structurally sound, generally impermeable buildings by installing watertight closures to windows, doors or other openings. Flood shields are commonly used to close off openings. These shields are usually made of aluminum, steel or wood. In commercial or industrial structures, these flood shields may be permanently installed on hinges or rollers for swinging or sliding into place. In residential structures, the shields are usually stored nearby for installation during a flood. Doorways or windows not needed may be permanently closed in with masonry or other relatively impermeable materials. Waterproofing sealants are sometimes applied to floors and walls to prevent seepage. Sewer lines and other plumbing facilities can be floodproofed by the installation of backflow valves and gate valves.

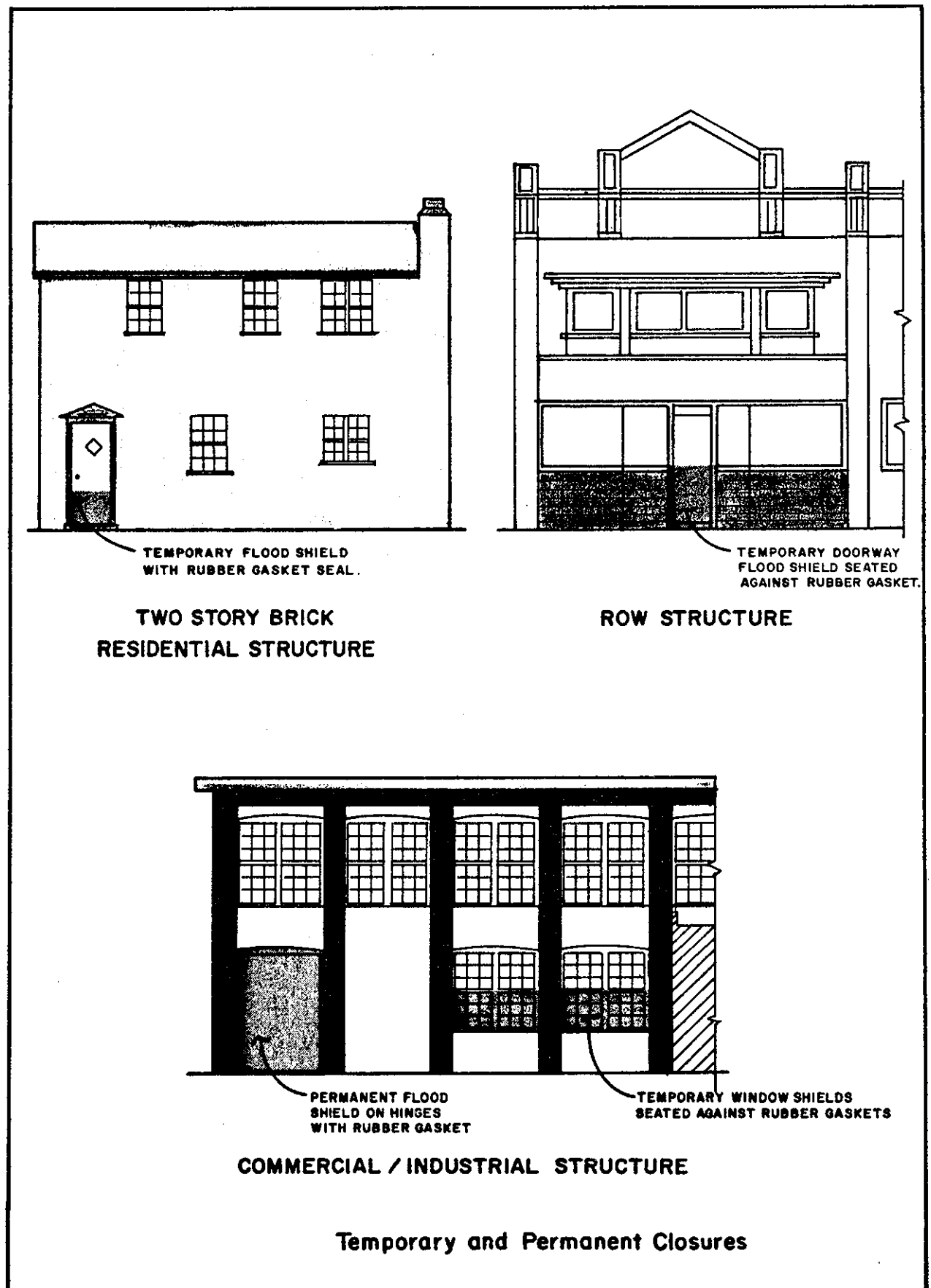


FIGURE 9

Floodproofing - The use of closures

Part IV - Administration and Operation of a Flood Plain Management Program in Rhode Island

A. Community Status

At this time, no community in Rhode Island has implemented a complete flood plain management program, although all are involved in some phase of the NFIP and have adopted regulations in conjunction with this.

B. Coordinating Agency

It would be necessary to have one agency at the state level to oversee the operation of management programs in Rhode Island. Dependent upon the amount of authority the state chooses to vest in this agency, this agency could have the power to settle multijurisdictional problems. A further discussion of the state's role in such a program is found in Section C.

C. Role of Administrators at Each Governmental Level

In order for a flood plain management program to work, it is necessary to have coordination and cooperative development of information and other related technical planning and construction assistance among all concerned interests at the local, State and Federal levels.

For the most part, the tools of a flood plain management system are available, but the authority to utilize them is dispersed among different levels of government. Furthermore, at each governmental level, responsibility for the enactment and enforcement of a flood plain management program is often spread across several agencies.

With active and coordinated Federal participation and support, State planning agencies, with the legislative authority necessary to initiate the programs, with firsthand knowledge of conditions, and with proximity to the problems, are the best situated to assume the lead role of supervising substate regional organizations and local governments.

1. Federal

Although the major responsibility for regulating flood plain use is non-Federal, the programs of the Federal government are increasingly influencing flood plain management decisions, either directly or indirectly. The Federal role should become more supportive of ongoing flood plain management activities and encourage adoption of similar programs where there are none. The Federal role should continue to be strong in information gathering, developing flood plain management criteria, funding programs, and in technical, planning and construction services.

Many Federal agencies offer State and local governments, as well as interested private citizens, a great amount of information and technical assistance in flood plain management. The following is a list of some of the agencies and a brief description of their functions:

Army Corps of Engineers - Part of the Department of Defense, the Flood Plain Management Services (FPMS) staff of the Corps performs technical services for other Federal agencies; performs flood plain delineation studies for the National Flood Insurance Program; responds to requests from State and local governments and from private citizens for flood hazard information on specific locations and for guidance in flood plain management planning and regulation; publishes guides, pamphlets and studies to support sound flood plain management practices; and sponsors training programs to promote the wise use and protection of flood-prone areas.

Federal Insurance Administration (FIA) - Part of the Federal Emergency Management Agency, the FIA administers the National Flood Insurance Program (NFIP) which seeks to limit flood losses by requiring communities to properly manage flood plain development. The FIA accomplishes this by: (a) conducting detailed engineering studies of water courses, (b) delineating floodways and floodway fringes, (c) requiring communities to adopt flood plain management regulations, (d) subsidizing insurance for structures already in flood risk areas and requiring insurance at actuarial rates for new structures proposed for flood risk areas, and (e) restricting grants of Federal benefits for buildings in known flood-risk areas in communities that choose not to participate in the NFIP.

Geological Survey - Part of the Department of the Interior, the U.S. Geological Survey collects basic information on the flow of streams, including maximum flows during floods. This streamflow data is used for flood analysis by government and other researchers and planners.

In addition, USGS prepares detailed reports on major floods for use by professional hydrologists and engineers; prepares shorter hydrologic atlases on floods for use by planners and laymen; conducts research on flood frequency and effects of urbanization on floods; prepares maps of flood-prone areas; and prepares flood insurance studies.

National Oceanic and Atmospheric Administration - Part of the Department of Commerce, NOAA is the home of the National Weather Service. In addition to its familiar weather forecasts, and its precipitation and temperature data, NOAA operates flood warning systems and keeps watch over hurricanes. NOAA also prepares studies defining coastal flood hazard areas for the National Flood Insurance Program.

New England River Basins Commission (NERBC) - The river basin commissions, established under Title II of the Water Resources Planning Act, as permanent regional institutions and composed of Federal and State

members, are in a strategic position to guide, coordinate, and unify both Federal and State programs for managing flood plains. Because they are continuing institutions with full-time professional staff, much can be expected of these commissions in coordinating the schedules, priorities, and resources necessary to implement flood plain management programs in their regions.

2. State

At the intrastate level, responsibility for coordination lies with the individual State's government. Each state is vested with the police power, which, by specific delegations to local government, provides the framework for much of the decisionmaking. The State government is close enough to the problems to deal with specifics. Multijurisdictional problems not manageable at the local level can usually be resolved at the State level.

It is the role of each state to determine the strategy that would best serve the needs and goals of their particular area. It is at this level that standards and procedures are set to allow for guidelines.

At the substate regional level, the State is directly involved in some coordinating activity for example, through the Office of Management and Budget's A-95 review program and the water quality planning requirements of the Clean Water Act. For the National Flood Insurance Program, the Governors have appointed State coordinators who often serve as coordinators in other water resources programs. A single statewide coordinating office is needed in each state to foster vigorous management programs that will encourage flood plain management in local and regional comprehensive planning and will maintain liaison with Federal agencies, including the proposed flood plain management committee.

3. Local

As discussed earlier, it is the responsibility of each community to determine the elements of a flood plain management program that would best suit the needs and requirements of their area, their past flooding experiences and their future development plans.

All of the communities in Rhode Island are enrolled in the National Flood Insurance Program and therefore have adopted and enforced flood plain management measures consistent with NFIP criteria. These locally enacted regulations are an essential complement to corrective and preventive measures if flood plain management is to be effective in mitigating flood losses. The existence of local regulatory programs should be used by Federal and State agencies as a condition of providing financial assistance to local management programs.

Local adoption of land use and construction controls is but the start of the regulatory process in flood plain management. To assure that these regulatory measures and objectives are readily understood and accepted by governmental officials and the public and thereby effectively carried out, there should be a continual assessment of local capabilities and need for assistance.

For most flood plain management activities, the local government has the responsibility to initiate application to State and Federal agencies for participation in and assistance from the various programs. The local government must also enact and enforce land and water use regulations and in some cases maintain and operate structures on the flood plain. Thus, to achieve effective flood plain management decisions by obtaining needed levels of technological, planning, and financial assistance, local governments must be provided with complete and current information about State and Federal programs.

D. Significant Related Legislation

Beginning in the late 1960's a number of resource protection and management measures were enacted to assist in the sound management and use of flood plain areas. Major components of Rhode Island's current flood mitigation program include:

1. Fresh Water Wetlands Act

Regulations under this Act, which is administered by the State Department of Environmental Management, require that a permit be obtained prior to the alteration of any wetland including the 100-year flood plain. Applications are evaluated as to their potential impact upon the flood plain including "reduction in the volume of a flood plain" and "reduction of the ability of a wetland to moderate the damaging effects of flood flows," in cases where significant filling is proposed, compensatory excavation or other adjustment is generally required.

2. Coastal Resources Management Program

Policies and regulations governing development in the State's coastal zone were adopted under the authority of the 1971 Coastal Resources Management Act. Specific regulations relative to construction in highly hazardous coastal areas include: prohibition of new construction on barrier beaches defined as undeveloped; prohibition of construction or restoration of structures on the beach face or dunes of presently developed barriers; and the requirement of a six-foot freeboard above the FIA still-water elevations for structures in V-zones on developed barrier beaches. These regulations are enforced via a coastal permit process including review by State agency staff and the Coastal Resources Management Council.

Definitions:

- a. Flood or flooding: a general and temporary condition of (1) partial or complete inundation of normally dry land areas from the overflow of inland and/or tidal waters and/or (2) the unusual and rapid accumulation or runoff of surface waters from any source.
- b. Flood hazard: the potential for inundation involving the risk to life, health, property, and natural flood plain values. Two reference floods are commonly used: (1) the 100-year flood is that flood which has a one-percent chance of being exceeded in any given year, also known as the base flood; and (2) the 500-year flood is that flood which has a 0.2 percent chance of being exceed in any given year.
- c. Flood Insurance Rate Map (FIRM): the official map in which the Federal Insurance Administration (FIA) has delineated both the areas of special flood hazards and the risk premium zones applicable to the community.
- d. Flood Insurance Study: the official report in which the FIA provides flood profiles, and the FIRM as well as the Flood Hazard Boundary Map and the water surface elevation of the base flood.
- e. Flood plains: the lowland and relatively flat areas adjoining inland and coastal waters, and those other areas subject to flooding.
- f. Flood plain preservation: the prevention of any modifications to the natural flood plain environment or the maintenance of the flood plain environment in a condition as close as possible to its natural state using all practicable means.
- g. Flood plain restoration: the reestablishment of a setting or environment in which the natural functions of the flood plain can again operate.
- h. Flood plain values: those natural and beneficial attributes associated with the relatively undisturbed state of the flood plain and include values primarily associated with water, living and cultural resources.
- i. Floodproofing: any combination of structural and non-structural additions, changes or adjustments to structures, which reduce or eliminate flood damage to real property, water and sanitary facilities, structures and their contents.
- j. Floodway: the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot.

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